

### **REMARKS**

Applicants respectfully request reconsideration of the present application. No claims have been amended.

The present application is directed to absorption enhanced reformation (AER) of a carbon-based fuel, such as ethanol or gasoline, to form a product gas rich in  $H_2$ . The method includes the use of an absorbent material to absorb  $CO_2$ . The absorbent material advantageously has the ability to be regenerated (i.e., where the  $CO_2$  is desorbed from the absorbent) many times without losing a substantial amount of absorption capacity. In the prior art,  $CO_2$  absorption materials lose their capacity to absorb  $CO_2$  after several cycles of absorption and desorption.

Those skilled in the art clearly recognize that multiple sorption-desorption cycles typically deteriorate the ability of the  $CO_2$  absorbent material to continue to absorb  $CO_2$ . Applicants submit that the ability to cycle a  $CO_2$  absorber material as recited in the present claims is not obvious in view of the references relied upon by the Examiner, as the prior art materials are not capable of maintaining a high absorption capacity over many cycles.

### **CLAIM REJECTIONS – OBVIOUSNESS-TYPE DOUBLE PATENTING**

The Examiner has also provisionally rejected all pending claims on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-65 of copending Application No. 10/996,791. The Examiner states that although the conflicting claims are not identical, they are not patentably distinct from each other because the claims of 10/723,424 and 10/996,791 disclose a method for converting a carbon-based fuel into a hydrogen-rich product gas using similar process steps.

Since none of the claims of these applications have been patented, Applicants request that this rejection obviousness-type double patenting rejection be held in abeyance until patentable subject matter is indicated in at least one of the applications.

### CLAIM REJECTIONS – 35 USC § 103

The Examiner has also rejected Claims 29-61 and 84-98 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,682,838 by Stevens. The Examiner has also rejected Claims 1-4, 6-29, 33-62 and 65-98 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication 2002/0085967 by Yokota.

For each of the foregoing rejections, the Examiner states that the difference between the Applicants' claims and the cited reference is that the Applicants' claims call for repeating the absorption and regeneration step at least 10 times, wherein the absorbent material retains at least about 50 mol.% of the theoretical absorption capacity after each of the regenerating steps. The Examiner's position is that this difference would have been obvious to one of ordinary skill in the art at the time the invention was made because it is reasonably expected that the processes disclosed in these documents would also undergo the same number of absorption and regeneration steps when treating the same gas with the same amount of carbon dioxide with the *same absorbent in the same quantity*, as a function of mass balance.

The Examiner's rejection is thus premised on the postulation that the Stevens and Yokota references disclose the same absorbent as the absorbent that is utilized in accordance with the present invention. Applicants traverse this rejection on the basis that: i) the absorbents are not the same; and ii) the absorbents disclosed by Stevens and Yokota do not exhibit the properties recited in the claims.

Although the absorbent that is utilized in accordance with the present invention may be the same chemically as the prior art absorbents (e.g., dolomite or CaO), the absorbents utilized in the present invention differ from the prior art absorbents structurally. It is this structural difference that enables the absorbents to be cycled many times without losing substantial absorption capacity, particularly as compared to prior art absorbents.

As is discussed throughout the present specification, the absorbents of the present invention possess unique absorption-desorption characteristics due to the

unique structural characteristics that can be imparted to the absorbents by a process such as spray processing. The absorbents are not chemically unique, but possess structural and morphological properties that differentiate them from the prior art.

By way of illustration, a material such as calcium oxide (CaO) can exist in many forms. It can be dense or porous, highly crystalline or amorphous, high surface area or low surface area, etc. In each case, the material is the same chemically, but significantly different structurally and morphologically, and therefore can exhibit a wide range of properties, and the affects of multiple absorption and desorption cycles will be different.

The Examiner has rejected the pending claims on the premise that the absorbent materials disclosed the prior art inherently have the same absorption characteristics as the absorbents that are utilized in the method of the present invention. The inherent teaching of a prior art reference, a question of fact, arises both in the context of anticipation and obviousness. *In re Napier*, 55 F.3d 610, 613, 34 USPQ2d 1782, 1784 (Fed. Cir. 1995).

However, the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

In relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990).

Applicants respectfully submit that the Examiner has not provided any basis in fact or technical reasoning to support the conclusion that the absorbents disclosed by the references possess the characteristics that would enable their use in claimed method.

### **Stevens**

Stevens is directed to the generation of hydrogen from fuels using absorption enhanced reforming. The absorbent utilized by Stevens can be selected from a long list of compounds (Col. 2, lines 2-15) and no particular fabrication method is disclosed for the absorbent materials. Further, there is no disclosure or suggestion by Stevens that the absorbent material utilized therein is not subject to the same limitations as the prior art materials discussed in the present application and discussed in other previously-noted references of record. Indeed, the examples of Stevens utilize an absorbent that is "available commercially" (see Col. 8, lines 48-62). Although the gas product over 10 cycles is disclosed in Fig. 6 of Stevens, no data is provided with respect to performance of the dolomite absorbent over 10 cycles.

The absorbent of Stevens would be subject to the same limitations discussed above and would not be capable of use in the method recited in the pending claims since the absorption capacity would decrease significantly over multiple cycles. As is noted above, the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. The Examiner has not demonstrated any technical reasoning to support the conclusion that the absorbents of Stevens possess the claimed characteristics.

### **Yokota**

Yokota discloses the generation of hydrogen from fuels using absorption enhanced reforming. The absorbent utilized by Yokota can be an oxide of an alkali metal or alkaline earth metal [Paragraph 0063] which is dispersed on an inorganic porous support, such as  $\text{MgAl}_2\text{O}_4$  or  $\text{ZrO}_2$ . No particular fabrication method is preferred for the absorbent material. Further, there is no disclosure or suggestion by Yokota that the absorbent material utilized therein is not subject to the same limitations as the prior art materials discussed in the present application, and as has been noted in other references of record.

It can only be concluded that the absorbent of Yokota possesses no unique structural or morphological properties, and therefore would be subject to the same limitations and would not be capable of use in the method recited in the pending claims. The Examiner

has not demonstrated any technical reasoning to support the conclusion that the absorbents of Yokota possess the claimed characteristics, as is required by *Ex parte Levy*. Therefore, removal of the rejection of the pending claims over Yokota is also requested.

Applicants believe that all pending claims are in condition for allowance and such disposition is respectfully requested. In the event that a telephone conversation would further prosecute and or expedite allowance, the Examiner is invited to contact the undersigned.

Respectfully submitted,

MARSH FISCHMANN & BREYFOGLE LLP

Date: May 11, 2007

By: /David F Dockery Reg No 34323/  
David F. Dockery  
Registration No. 34,323  
3151 South Vaughn Way, Suite 411  
Aurora, Colorado 80014  
(303) 338-0997